# Psychometric Properties & Test scores

# Or…

# How to Understand Test Scores & Whether a Test is Any Good

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# Why bother?

- Why not get to the tests already?
- Because we don't have time to cover all the tests you might see in your cases
- This knowledge applies to all psychological tests & will help you evaluate the quality of the tests used in the work psychologists do for you or for opposing attorneys

# This morning…

- Learn about psychometric properties – three major considerations in judging the strength of a test:
  - Reliability
  - Validity
  - Standardization
- Gain an understanding of the types of scores used in most psychological tests:
  - Percentiles
  - Standardized scores

# Psychometric Properties

- Aspects of a test that tell you how good it is
- Ways you can judge the strength of a test

- Obviously, if a test is being used to speak to a forensic issue, it must be strong
  - It is the psychologist's responsibility to consider the psychometric properties of the tests they use
  - Must ensure the test is appropriate & strong enough to use for any particular person in any given situation
    - A great test isn't great for everyone or for all situations

# Reliability

- Key word: Consistency

- Reliability is the degree to which a test measures something consistently
  - Is someone going to get the same score each time the test is taken?
- A reliable test will produce consistent scores.
  - Think of a scale measuring someone's weight
  - Stop #1 - if you don't have reliability, nothing else about the test matters!

# Reliability

- There are many different types of reliability or ways to evaluate the consistency of a test
- Two of most common:
  - Test-retest reliability – does someone get similar scores when taking same test two different times
  - Internal consistency (alpha coefficient) – does someone score consistently on similar items throughout a test
- Results of reliability studies will be in test manual.

# Reliability

- All types of reliability are represented quantitatively by a correlation coefficient
- A number that ranges from 0.00 to 1.00
  - The closer to 1.00, the more reliable
- Generally, when using a test to make decisions about an individual, reliability should be >.90
  - There may be exceptions to this rule

# Reliability

- Once you know the reliability, you have an idea of how much the test score might change if the test was taken again.
- Reliability tells you how much error is related to a given test score
- Can use this to calculate a confidence interval:
  - A range of scores that represents where the person may score if taken again and again
  - Confidence intervals are less precise, but more accurate ways of reporting test scores
  - This point will be illustrated with the WAIS-IV later

# Reliability: In Sum

- Consistency of test scores
- Reliability is a continuum, not a yes or no issue
- Tells how much error you have to consider when interpreting a test score
- Can use to create range of scores (confidence interval) to have better idea of "true" test score

# Validity

- Key Word: Accuracy
- A test is valid if it measures what it is supposed to measure and does so accurately.
- This is the most important aspect of a test because if it isn't valid, no conclusions can be drawn from it. It is useless!

# Validity

- Validity is also NOT a yes or no issue.
- It is a collective consideration of everything that is known about how a test works.
  - For whom it works
  - Under what conditions it works
  - What conclusions can be drawn
  - What limitations must be considered

# Validity

- Validity is a fluid issue that changes over time.
  - Initial validation is done by the test creator.
  - Must show it works right to be published.
- After that time, ongoing research studies and clinical use can provide further evidence for use of the test or limitations for use.
  - Show the test works for additional groups, under other conditions, with different race or age groups, etc.

# Validity

- Different types of validity speak to different ways we can feel confident the test works and measures what it intends to measure.
  - Content validity – got the right items in the test
  - Criterion-related validity – test works the same way other similar measures work, can predict outcomes accurately
  - Construct validity – any way can gather evidence to show the test is working

# Validity: In Sum

- Validity: Accuracy, Usefulness
- Validity is a collective issue – consider all evidence and make a judgment about how well the test works.
- Psychologist should be aware of validation studies done both prior to and after publication of a test being used.

# Standardization

- Most tests in psychology are interpreted by comparing the score someone gets to the scores of others
  - Called norm-referenced tests
  - Different from classroom exams!
- Normative group/Standardization sample
  - Group of people who's scores will be used for comparison
  - Frame of reference for interpreting test scores
- The process of gathering the test scores is called test standardization

# Standardization

- Interpretations made from a test are only as good as the standardization.
  - Can't know how well someone does if the group you are comparing his/her scores to is not representative of the people for whom the test is intended.
- So MUST have a representative group
  - If the norms don't represent the population for whom the test was intended, they are useless and all comparisons made will be useless.

# Standardization

- Things to consider:
  - Size of group
  - Age range
  - Race/Ethnicity
  - Gender/Sex
  - Geographic representativeness
  - SES
  - When norms were collected (some get dated quickly)
  - Any other factor that could affect the scores

# Standardization

- It is the psychologists responsibility to only use a test that is appropriate for the person they are testing.
  - Should not use a test that has not been normed on populations similar to the person being tested because the comparison may not be accurate

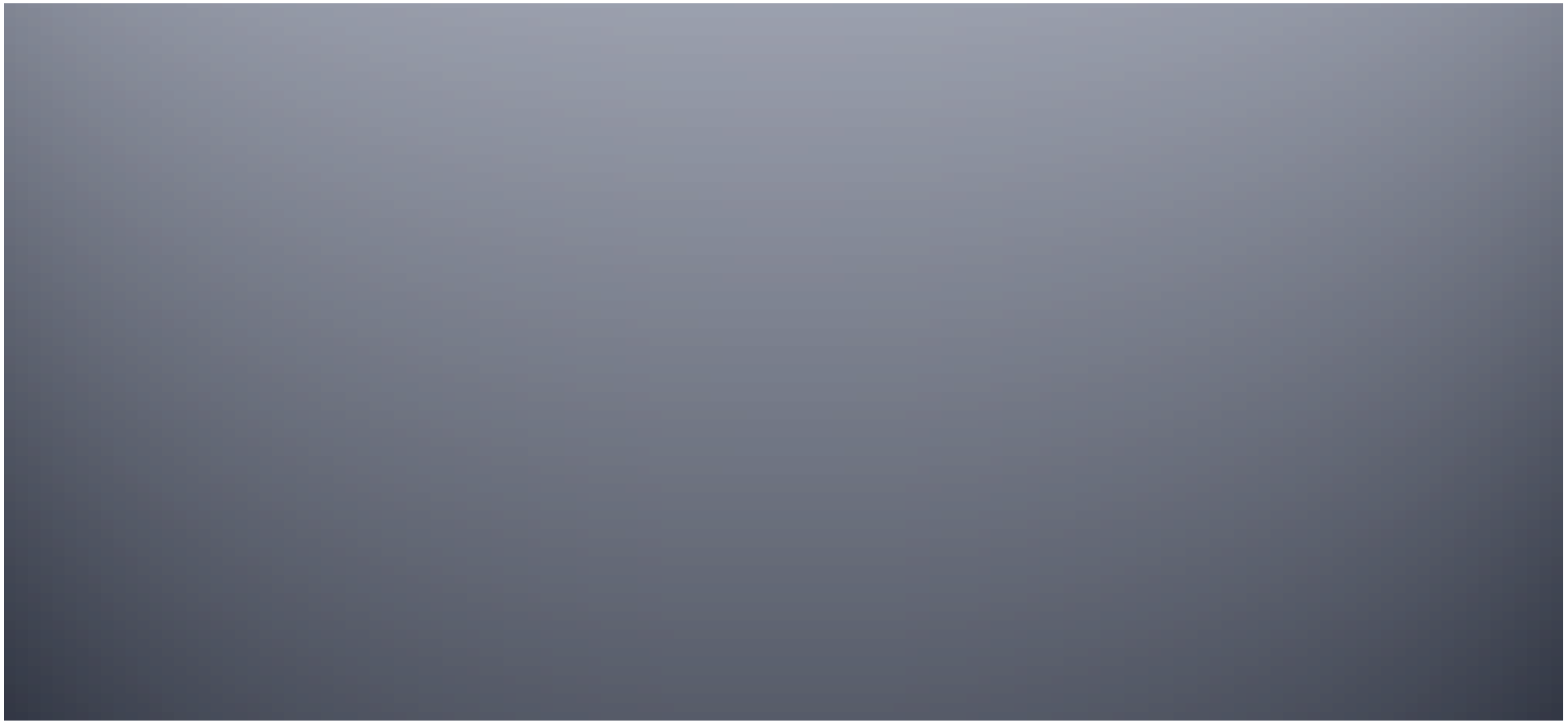
# Standardization: In Sum

- The process of gathering data to use as a comparison group for test interpretation
  - Norm group, standardization sample
- Must ensure the group provides an appropriate comparison for the person being tested
  - If not, any conclusions made can be tentative, at best

# Psychometric Properties

- Three important issues to consider when selecting, and then using, a psychological test.
  - Reliability - consistent test scores
  - Validity - relevant, meaningful test scores
  - Standardization - appropriate comparison group
- The expert using the test must have considered these and is responsible for only using tests that are appropriate for the person and situation.

# Understanding Test Scores



# Understanding Test Scores

- Three things to understand regarding scores seen in most commonly used psychological tests:
  - Raw Scores
  - Percentiles
  - Standardized Scores

# Here's the secret….

- Psychological test interpretation is all about comparisons.
  - How did someone do in comparison to others?
  - Did they score the way most other people do?
  - Did they score much higher than is typical?
  - Did they score much lower than average?
- This works for many kinds of tests…
  - IQ
  - Clinical scales
  - Personality scales

# Understanding Test Scores

- Why do we do this?
- Because there are many different tests that measure the same or similar constructs
  - IQ Tests – dozens of good ones out there
    - Differ in number of items, difficulty level, types of items
    - So can't directly compare the actual score someone gets on these tests – 50% right on one test may be VERY different from 50% right on another test
- So we convert the raw scores on tests to other scores that we can use for all tests
  - Like changing to the same language

# Understanding Test Scores

- How does it work?
  - Start with the person's raw score (# they got right on the test)
    - 60/100 on an IQ test (60% correct)
  - Convert that score into a universal score that represents how similar or different they scored from others who take the test
    - Compare to norms
      - if average score = 30 – this is really good!
      - If average score = 80 – this is not so good!
    - Change raw score to a score that shows how close or far the person's score is from the average or typical score for their age/gender, etc.

# Understanding Test Scores

- There are many different types of scores that raw scores can be changed to in order to make a comparison
  - Percentiles
  - Standardized Scores

# Percentiles

- An easy comparison that tells the percent of the population that the person scored above
  - 80$^{th}$ percentile – did better than 80% of people who took the test
- Very commonly used
- Remember: this doesn't tell you their score at all, just how they did in comparison to others
  - NOT a percentage, but a percentile

# Percentiles

- So get 60 out of 100 on an IQ test…
  - If this falls at the 25$^{th}$ percentile – not so god
  - If this falls at the 85$^{th}$ percentile – very good
- Get an immediate understanding of how they performed
  - Can easily calculate – but don't have to!
  - There will be conversion charts in test manual using norm group for comparison
    - Just look up raw score obtained & will find percentile
    - Most tests use different charts for age groups, gender, etc.

# Percentiles & Standardized Scores

- Percentiles are great but they are limited because they only tell you what "place" someone came in - doesn't tell you how close or far that score is from the other scores

- Alternative comparison: standardized scores

# Standardized Scores

- There are many & they all work the same way.
- There is a middle (mean or average) & there is a set amount that describes how much scores vary or how far they are from the average or most typical score (standard deviation)
- Use these two numbers to convert a raw score to a standardized score – one that tells you how a person scored in comparison to others
  - T Score, IQ Score

# T Scores

- Used on many personality & clinical scales
  - MMPI-2, CPI, PAI, etc.
- T Scores (Mean = 50, Standard Deviation = 10)
- Any time see a score of 50 = average
  - The higher above 50, the better they did
- Use SD to know how FAR above or below average
  - T score of 70
    - 2 SD above the mean – very high (98$^{th}$ percentile)
  - T score of 40
    - 1 SD below the mean – moderately low (16$^{th}$ percentile)

# T Scores

| T Score | Percentile | Descriptor |
|---|---|---|
| >70 | >98$^{th}$ | Very high & very unlikely |
| 70 | 98$^{th}$ | Clinically significant |
| 60 | 84$^{th}$ | Borderline |
| 50 | 50$^{th}$ | Average |
| 40 | 16$^{th}$ | Below Average |
| 30 | 2$^{nd}$ | low, maybe clinical |
| <30 | <2$^{nd}$ | Very low & very unlikely |

Regardless of the test, any time you see a T score this is the "code" to understanding someone's performance

# IQ Scores

- Work the same way as T scores
- IQ score: Mean = 100, SD = 15*
  - So anytime you see an IQ of 100 you know it is average

| IQ Score | Percentile | Descriptor |
|---|---|---|
| 130 | 98th | Very high, genius |
| 115 | 84th | Above Average |
| 100 | 50th | Average |
| 85 | 16th | Low Average |
| 70 | 2nd | Very low, Mental Retardation |

- *A few IQ tests use a SD of 16 instead

# IQ Scores

- This is the "code" for understanding the scores used on IQ tests.
  - Doesn't matter how many items, the difficulty level, what subtests included – because once transformed to IQ scores the scores all mean the same thing
- Will show more when talk about the WAIS-IV

# Test Scores: In Sum

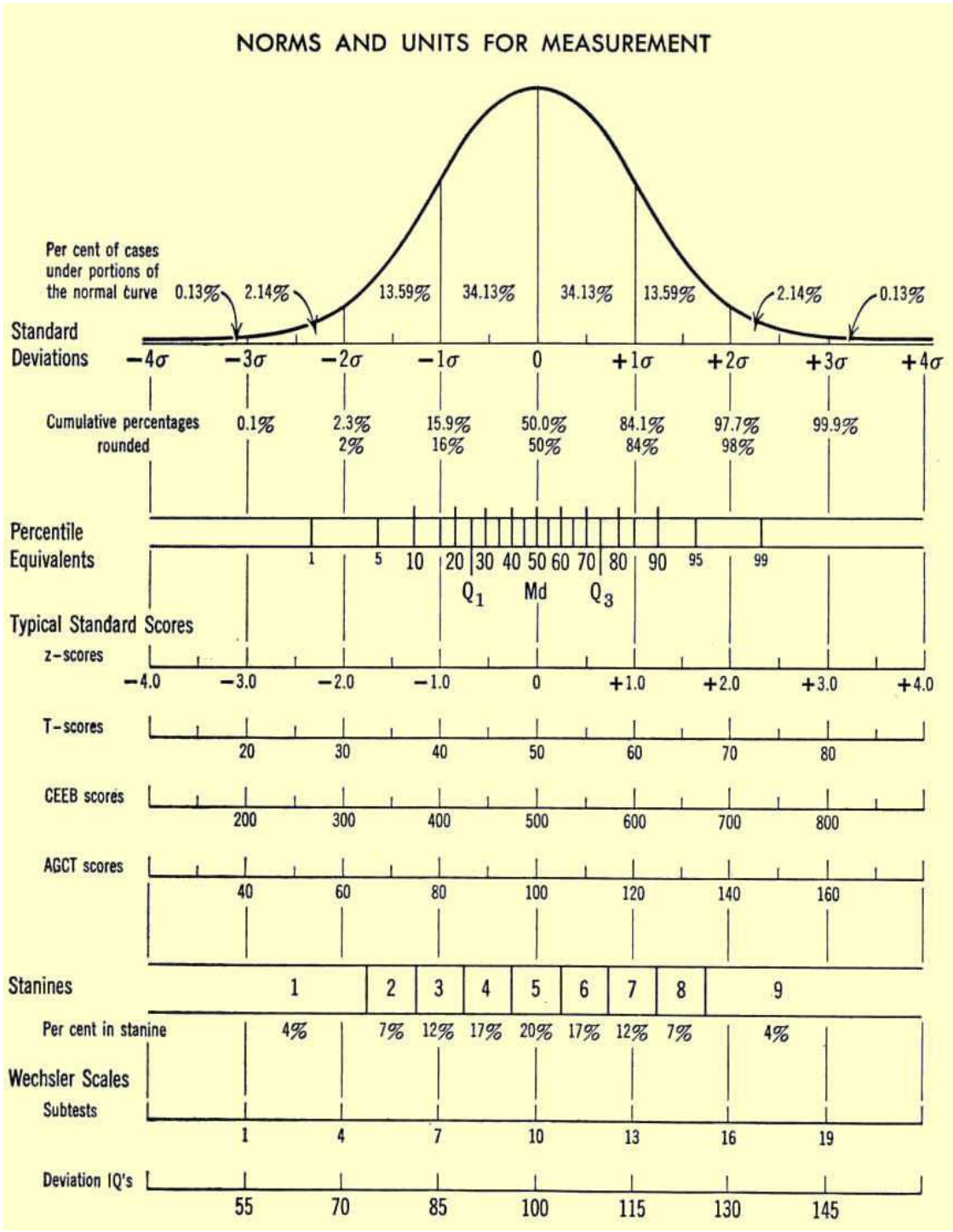
- Raw scores don't mean anything
- Must convert to some type of comparison-based score
  - Percentiles
  - Standardized scores
- Once converted, these scores tell you how close to or far from average a person scored
  - Doesn't matter what test they took, same conversion is used
  - Clinical interpretation may differ from test to test

# Test Scores: In Sum

- T Scores & IQ Scores are just 2 types of standardized scores – there are many!
  - Each has a preset Mean & SD (these vary)
  - Each test will have conversion tables for whichever type of score is used

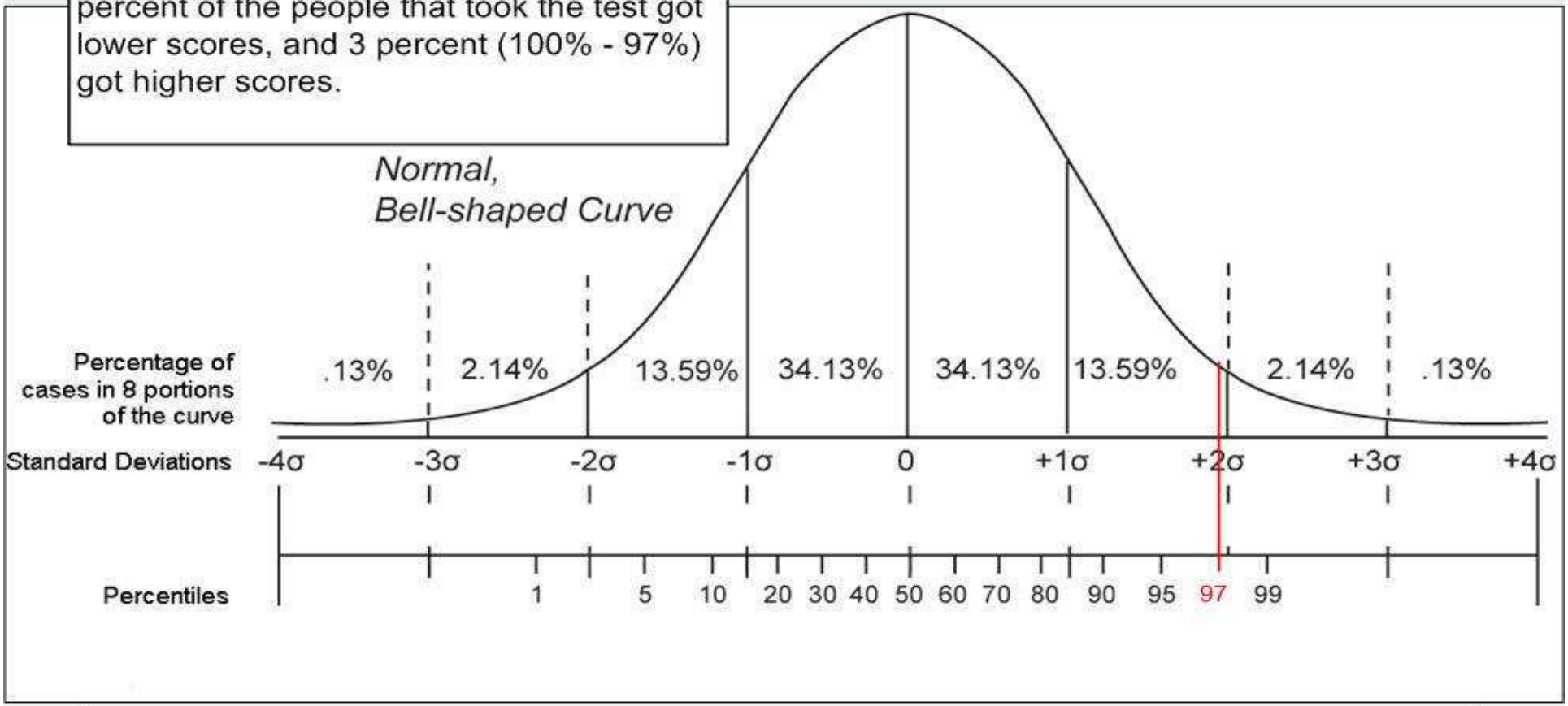
- See graph

# NORMS AND UNITS FOR MEASUREMENT



# Percentiles

**A percentile rank** shows the percentage of people that scored above and below a certain score. For example, if a score falls in the 97th percentile, it means that 97 percent of the people that took the test got lower scores, and 3 percent (100% - 97%) got higher scores.




Bell curve labeling was adapted for our purposes. Source of bell curve: http://en.wikipedia.org/wiki/File:PR_and_NCE.gif